What is claimed is:

1. A polymer-clay nanocomposite comprising:

   (i) a melt-processible matrix polymer, and incorporated therein

   (ii) a mixture of at least two swellable layered clay materials.

2. The nanocomposite of claim 1, wherein the melt-processible matrix polymer comprises a polyester, polyetherester, polyamide, polyesteramide, polyurethane, polyimide, polyetherimide, polyurea, polyamideimide, polyphenyleneoxide, phenoxy resin, epoxy resin, polyolefin, polyacrylate, polystyrene, polyethylene-co-vinyl alcohol, or a copolymer thereof, or a mixture thereof.

3. The nanocomposite of claim 1, wherein the melt-processible matrix polymer comprises poly(m-xylylene adipamide), EVOH, or a copolymer thereof, or a mixture thereof.

4. The nanocomposite of claim 1, wherein the melt-processible matrix polymer comprises poly(ethylene terephthalate) or a copolymer thereof, or a mixture thereof.

5. The nanocomposite of claim 1, comprising greater than zero to about 25 weight percent of layered clay material.

6. The nanocomposite of claim 1, comprising from about 0.5 to about 15 weight percent of layered clay material.

7. The nanocomposite of claim 1, comprising from about 0.5 to about 10 weight percent of layered clay material.

8. The nanocomposite of claim 1, wherein the mixture of layered clay materials comprises natural, synthetic or modified phyllosilicates.

9. The nanocomposite of claim 1, wherein the mixture of layered clay materials comprises natural, synthetic or modified montmorillonites, saponites, hectorites, micas, vermiculites, bentonites, nontronites, beidellites, volkonskoites, magadites, kenyaites, or mixtures thereof.

10. The nanocomposite of claim 1, wherein the mixture of layered clay materials includes bis(2-hydroxyethyl) octadecyl methyl ammonium montmorillonite and dodecyl ammonium montmorillonite, octadecyl trimethyl ammonium montmorillonite and tetramethyl ammonium montmorillonite, dodecyl ammonium montmorillonite and tetramethyl ammonium montmorillonite, or dodecyl ammonium montmorillonite and sodium montmorillonite.

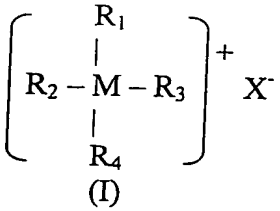
11. The nanocomposite of claim 1, wherein the layered clay materials are free flowing powders having a cation exchange capacity from about 0.9 to about 1.5 meq/g.

12. The nanocomposite of claim 1, wherein at least 50 percent of the layered clay materials are dispersed in the form of individual platelet particles and tactoids in the matrix polymer.

13. The nanocomposite of claim 12, wherein the tactoids have a thickness of less than about 20 nm.

14. The nanocomposite of claim 1, wherein the mixture of layered clay materials is intercalated with an organic cation or a mixture of organic cations.

15. The nanocomposite of claim 14, wherein the organic cation is represented by the formula (I):



(I)

wherein M is either nitrogen or phosphorous; X^- is a halide, hydroxide, or acetate anion, preferably chloride and bromide; and R_1, R_2, R_3, and R_4 are independently organic and/or oligomeric ligands or may be hydrogen.

16. The nanocomposite of claim 14, wherein the organic cation is derived from an onium salt compound comprising an ammonium or phosphonium salt compound.

17. The nanocomposite of claim 14, wherein the organic cation comprises an alkyl ammonium ion, an alkyl phosphonium ion, a polyalkoxylated ammonium ion, or a mixture thereof.

18. The nanocomposite of claim 17, wherein the alkyl ammonium ion comprises tetramethyl ammonium, hexyl ammonium, butyl ammonium, bis(2-hydroxyethyl dimethyl ammonium, hexyl benzyl dimethyl ammonium, benzyl trimethyl ammonium, butyl benzyl dimethyl ammonium, tetrabutyl ammonium di(2-hyrdoxyethyl) ammonium, dodecyl ammonium, octadecyl ammonium, octadecyl trimethyl ammonium, bis(2-hydroxyethyl) octadecyl methyl ammonium, or octadecyl benzyl dimethyl ammonium.

19. The nanocomposite of claim 17, wherein the alkyl phosphonium ion comprises tetrabutyl phosphonium, trioctyl octadecyl phosphonium, tetraoctyl phosphonium, or octadecyl triphenyl phosphonium.

20. The nanocomposite of claim 17, wherein the polyalkoxylated ammonium ion is derived from a hydrochloride salt of oligooxyethylene amine with a number average molecular weight of about 1100 g/mol, a hydrochloride salt of oligooxypropylene amine with a number average molecular weight of about 640 g/mol, a hydrochloride salt of octadecyl bis(polyoxyethylene[15])amine or octadecyl bis(polyoxyethylene[15]) ammonium chloride, wherein the numbers in brackets are the total number of ethylene oxide units.

21. The nanocomposite of claim 17, wherein the alkyl ammonium ion comprises tetramethyl ammonium, hexyl ammonium, butyl ammonium, bis(2-hydroxyethyl dimethyl ammonium, hexyl benzyl dimethyl ammonium, benzyl trimethyl ammonium, butyl benzyl dimethyl ammonium, tetrabutyl ammonium di(2-hyrdoxyethyl) ammonium, dodecyl ammonium, octadecyl ammonium, octadecyl trimethyl ammonium, bis(2-hydroxyethyl) octadecyl methyl ammonium, or octadecyl benzyl dimethyl ammonium; and wherein the alkyl phosphonium ion comprises tetrabutyl phosphonium, trioctyl octadecyl phosphonium, tetraoctyl phosphonium, or octadecyl triphenyl phosphonium; wherein the polyalkoxylated ammonium ion is derived from a hydrochloride salt of oligooxyethylene amine with a number average molecular weight of about 1100 g/mol, a hydrochloride salt of oligooxypropylene amine with a number average molecular weight of about 640 g/mol, a hydrochloride salt of octadecyl bis(polyoxyethylene[15])amine or octadecyl methyl bis(polyoxyethylene[15]) ammonium chloride, wherein the numbers in brackets are the total number of ethylene oxide units.

22. The nanocomposite of claim 14, wherein the organic cation comprises tetramethyl ammonium, octadecyl trimethyl ammonium or a mixture thereof.

23. The nanocomposite of claim 1, wherein the melt-processible matrix polymer comprises poly(ethylene terephthalate) or a copolymer thereof and the mixture of layered clay materials comprises dodecyl ammonium montmorillonite, Wyoming-type sodium montmorillonite, or synthetic phyllosilicates.

24. The nanocomposite of claim 1, having an I.V. of at least 0.5 dL/g as measured in 60 wt%/40 wt.% phenol/tetrachloroethane at 25°C.

25. An article prepared from the nanocomposite of claim 1.

26. The article of claim 25 in the form of film, sheet, preform, profile, an extruded article, a molded article or a molded container.

27. The article of claim 25 in the form of a bottle.

28. The article of claim 25, having a gas permeability which is at least 10 percent lower than that of an article formed from a clay-free polymer.

29. An article having a plurality of layers wherein at least one layer is formed from the nanocomposite of claim 1.

30. The article of claim 29, wherein the nanocomposite is disposed intermediate to two other layers.

31. The article of claim 29, having one or more layers of a structural polymer.

32. A process for preparing a polymer-clay nanocomposite comprising:

(i) preparing a mixture of at least two swellable layered clay materials; and

(ii) incorporating the mixture with a matrix polymer by melt processing the matrix polymer with the mixture to form a polymer-clay nanocomposite.

33. The process of claim 32, wherein step (i) is conducted by intimately mixing at least two swellable layered clay materials in a solvent.

34. The process of claim 33, wherein the solvent is water, an alcohol, a chlorinated solvent, a ketone, an ester, an ether or a mixture thereof.

35. The process of claim 32, wherein step (ii) is conducted by a melt compounding extrusion process.

36. A polymer-clay nanocomposite made by the process of claim 32.

37. An article prepared from the nanocomposite of claim 36.

38. The article of claim 37 in the form of film, sheet, preform, profile, an extruded article, a molded article or a molded container.

39. The article of claim 37 in the form of a bottle.